Ecological conclusions from long-term growth series of beech (*Fagus sylvatica* L.) and Norway spruce (*Picea abies* Karst.) in Switzerland



Sabine Braun¹, Christian Schindler², Beat Rihm³ ¹Institute for Applied Plant Biology, Witterswil, Switzerland ²Swiss TPH, University of Basel, Switzerland ³Meteotest, Bern, Switzerland

Dataset

	Fagus sylvatica	Picea abies
number of plots	75	66
time period	1991-2014	1995-2014
number of increment periods analyzed	6	5
observations per increment period (number of trees)	5571	4543



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Development of stem increment in beech and Norway spruce

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Covariates used in the data analysis

- Soil chemistry (base saturation, pH)
- Foliar nutrients (N, P, K, Ca, Mg)
- Stand structure and tree position
- Age
- Drought: ETa/ETp spring and early summer
- Temperature
- N deposition
- Ozone (POD1)
- Time
- Cluster: site and year
- All possible interactions between significant predictors were tested one by one

Significant covariates marked in red

- Soil chemistry (base saturation, pH)
- Foliar nutrients (N, P, K, Ca, Mg)
- Stand structure and tree position
- Age
- Drought: ETa/ETp spring and early summer
- Winter Temperature
- N deposition
- Ozone (POD1)
- Time
- Cluster: site and year
- All possible interactions between significant predictors were tested one by one

Stem increment in relation to N deposition

1991-2014





Predicted values from the regression model, with covariates except N deposition set to their mean.

Model excluding foliar nutrients

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Stem increment in relation to N deposition

1991-2014





Predicted values from the regression model, with covariates except N deposition set to their mean.

Model excluding foliar nutrients

Stem increment in relation to N deposition



1991-2014



Predicted values from the regression model, with covariates except N deposition set to their mean.

Model excluding foliar nutrients

Interactions of stem increment in beech with nitrogen deposition



Predicted values from the regression model, with other covariates set to their mean.

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Interactions of stem increment in beech with nitrogen deposition



Predicted values from the regression model, with other covariates set to their mean.

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Which component explains how much of the growth decrease of beech between 1991-2014?

Model	% contri- bution
full model	86.0
Drought without interactions	21.1
Drought with interactions (N deposition, N:K)	66.9
winter temperature without interactions	23.0
winter temperature with interactions (N deposition, N:Mg)	77.8
foliar nutrients without interactions	21.3
N deposition without interactions	57.7
fructification	
age	
The partial models are NOT additive!	25
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Further information

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Growth trends of beech and Norway spruce in Switzerland: The role of nitrogen deposition, ozone, mineral nutrition and climate



Sabine Braun^{a,*}, Christian Schindler^b, Beat Rihm^c

^a Institute for Applied Plant Biology, Sandgrubenstrasse 25, 4124 Schönenbuch, Switzerland

^b Swiss TPH, University of Basel, Socinstrasse 57, 4056 Basel, Switzerland

^c Meteotest, Fabrikstrasse 14, 3012 Berne, Switzerland

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Epidemiological analysis of ozone and nitrogen impacts on vegetation – Critical evaluation and recommendations



Sabine Braun^{a,*}, Beat Achermann^b, Alessandra De Marco^c, Håkan Pleijel^d, Per Erik Karlsson^e, Beat Rihm^f, Christian Schindler^g, Elena Paoletti^h

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